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ABSTRACT

This study assessed whether learner control of feedback has a beneficial effect in student performance and attitude, focusing on whether the degree of elaboration feedback needed for high performance could be determined. Program and learner control were used at three levels of feedback, verification, correct answer, and elaboration. Subjects were 126 undergraduate education majors at a southwestern university, divided into 6 experimental groups. This study and a previous study demonstrate that verification feedback alone is insufficient for subjects to reach high levels of performance on a posttest. This study shows only a minimum improvement when elaboration was added to the correct answer feedback. The additional time and expense needed to design the instruction with elaboration feedback is probably not warranted, since students perform at almost the same level with only the correct answer. The pattern of improved performance from verification to correct answer was seen in program and learner-control conditions. Program control subjects always outperformed learner control subjects, and learner control subjects spent less time studying feedback than did program control subjects. Results suggest that program control with correct answer feedback is the most effective and efficient way to present instruction on the computer. (Contains 4 references.) (SLD)

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ED 362 194

Title:

Learner Control of Feedback in a Computer Lesson

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Although a great deal of research has been conducted on learner control and on feedback, few studies have been conducted to determine if leaner control of feedback will have a beneficial effect on student performance and attitude. According to Clariana, Ross, and Morrison (1991) feedback is an important variable that is often ignored in computer assisted instruction (CAI). Yet, it is possible to design instruction that allows learners to control the amount of feedback after a practice item. Using a computer to administer feedback can be an efficient process. A computer can act as a sophisticated tutor, capable of adjusting feedback to obtain effective and efficient instruction (Anderson, Boyle & Reiser, 1985).

In a previous study, we used program and learner control with two levels of feedback (verification and elaboration). These are the two components of feedback described by Kulhavy & Stock (1989). The results of that study showed that elaboration was significantly more influential than verification in producing greater performance. In this study, we wanted to see if the degree of elaboration feedback needed for high performance could be determined. We used program and learner control at three levels of feedback, which were verification, correct answer and elaboration.

Method

Subjects

Subjects were 126 undergraduate Education majors at a large southwestern university. They were told that the information would be useful to them as future teachers and that they would receive credit for participation in the study.

Procedures

This study was administered by microcomputer and had six conditions with 21 subjects in each group. All subjects read text, answered embedded practice questions and received feedback. They then completed a short attitude survey and a posttest consisting of the practice questions presented in random order.

Before subjects arrived to participate in the study, we prepared the computer laboratory by installing one of the six lessons into each computer. Upon arrival at the computer room, subjects were randomly assigned to each of the six conditions. Subjects were run in groups of about 25 with all conditions present at each session.

We gave a short introduction on general procedures and told subjects that instructions were included in

the program. They were not told that the programs were different. Subjects were told that the lesson was on reliability and validity and stressed the importance of the material for them as future teachers. Subjects then proceeded with their individual lessons. Upon completion of the lesson, each subject completed the attitude questionnaire and the posttest on the computer. Subjects were given as much time as they needed to complete the lessons and the criterion measures. Most subjects completed the study within a 50-minute class period.

The differences in treatments occurred in the type of control (program or learner) and level of feedback (verification, correct answer, or elaboration). Under the condition of program control/verification, a computer program delivered feedback telling subjects that their answer was correct or incorrect. Under program control/correct answer, the feedback delivered by the computer was whether or not the response was correct and the correct answer appeared on the screen. Under program control/elaboration, the computer showed subjects whether their response was correct, the correct answer, and a short explanation.

The three learner control conditions contained the same levels of feedback as program control conditions, but only appeared when learners chose to see the feedback for their condition. After learners responded to a practice question, they were asked one of three sets of questions as follows: 1) For the verification group - Would you like to check you answer? 2) For the correct answer group - Would you like to check you answer? Followed by - Would you like to see the correct answer? Or 3) For the elaboration group - Would you like to check your answer? Followed by - would you like to see an explanation?

Materials

Materials used in this study were six computer programs, a posttest, and an attitude questionnaire. The computer based lessons were developed from the text Topics in Measurement: Reliability and Validity by Dick & Hagerty (1971). Information and examples were presented in sections of five screens of text, followed by eight, five-alternative, multiple-choice questions. This cycle continued for a total of 25 screens of text and 40 questions.

Differences in the lessons were based on type of control (program or learner) and level of feedback (verification, correct answer, or elaboration). Program control groups received one of the levels of feedback automatically. Learner control groups received verification, or correct answer, or

elaboration when they requested feedback. Because verification was given to program control groups at all levels, learners with control in the correct answer and elaboration groups had to choose verification before they could choose to see the level of feedback assigned to that condition.

In addition to the six computer based lessons, a posttest and an attitude questionnaire were developed. The posttest consisted of the same 40 questions previously given as practice but presented in random order. The reliability of the posttest was calculated at .69 using the Kuder-Richardson 20 formula. The attitude questionnaire consisted of ten items measuring student satisfaction, enjoyment, perception of control, and feeling toward feedback. The questionnaire used a five point Likert-type scale. Both measures were administered on the computer. In addition, the computer automatically recorded the number of seconds each subject spent studying feedback messages.

Design

The design was a 2 x 3 factorial with type of control (learner or program) and level of feedback (verification, correct answer, or elaboration) as the independent variables. The dependent variables were performance, attitude, and feedback study time.

Results

Retention as measured by performance on the posttest revealed the influence of type of feedback. The mean scores for program control subjects on the posttest were 21.4, 29.7 and 30.8 for verification, correct answer and elaboration feedback respectively. The standard deviations associated with each mean were 4.8, 3.8 and 4.8 respectively. The mean scores indicated that when subjects were given the correct answer or the correct answer with elaboration, subjects performed better on a posttest than if they were only given verification. A similar pattern occurred for learner control subjects.

The mean scores for learner control subjects on the posttest were 20.3, 23.7 and 25.0 for verification, correct answer and elaboration feedback respectively. The standard deviations associated with each mean were 4.2, 7.5 and 6.4 respectively. Here again the same pattern of increased performance with increased amount of feedback emerges, but not as strongly as for program control subjects. Subjects who received verification feedback only did not perform as well as subjects who received either correct answer or elaboration feedback. Subjects who received elaboration feedback performed best whether they were program or learner control

subjects. Program control subjects performed better on the posttest than learner control subjects at comparable feedback levels.

An ANOVA analysis revealed significant main effects for scores on the posttests with type of control at $F(5,120)=19.67$, $p<.05$ $MSe=29.42$ and level of feedback at $F(5,120)=20.17$, $p<.05$ $MSe=29.42$. However the interaction did not reach the standard .05 level of significance. The interaction was significant at the .06 level.

The results of feedback study time showed that program control subjects spent more time studying feedback than learner control subjects. Program control subjects averaged 44.2, 101.7 and 232.0 seconds respectively for verification, correct answer and elaboration conditions. However, learner control subjects spent 26.5, 37.4 and 82.1 seconds for equivalent feedback conditions. An ANOVA analysis of feedback study time revealed a significant interaction $F(2,120)=22.46$, $p<.001$ $MSe=2101.90$.

To analyze the attitude survey, a MANONA analysis was first run to see if there were significant differences between the groups on all questions combined. Results revealed a significant MANOVA effect for level of feedback $F(20,100)=2.12$, $p<.05$. Follow-up univariate analysis showed two questions to be highly significant. The one question was "I would have liked more control over the lesson" $F(2,120)=5.31$, $p<.01$. The other question was "I would have liked more feedback about my answers" $F(2,120)=13.90$, $p<.01$.

Discussion

This study and the original study both demonstrated that verification feedback alone was insufficient for subjects to reach high levels of performance on a posttest. This study showed only a minimum improvement (one question on the forty-question posttest) when elaboration was added to the correct answer feedback. The additional time and expense needed to design the instruction with elaboration feedback is probably not warranted. Students would perform at almost the same levels when only given the correct answers.

The pattern of improved performance from verification to correct answer to elaboration was seen in both program and learner control conditions. Program control subjects always outperformed learner control subjects. This would lead one to recommend program over learner control. It should be mentioned, however, that there were greater differences in the standard deviations for learner control correct answer and elaboration conditions (7.5 and 6.4) than for the

other four conditions. Those conditions ranged from 3.8 to 4.8. The larger deviations were a result of several learner control subjects choosing very little feedback and doing poorly on the posttest but not poorly enough to be considered outliers that could be dropped from the analysis.

The results for the feedback study time were as expected. Learner control subjects spent less time studying feedback than program control subjects. When subjects were given the opportunity to skip feedback, they tend to do so. This resulted in lower scores on a posttest. Sometimes lower scores are offset by improved attitude toward the instruction. That was not the case with the current study.

No differences were found between types of control on the attitude study. The only differences were for level of feedback. Subjects who were only given verification were universally displeased with the lack of control and lack of feedback.

This study would suggest that program control with correct answer feedback is the most effective and efficient way to present instruction on a computer. However, additional research with different subject matter and different age subjects would be warranted. More sophisticated programs could also be developed that would only allow learners to omit feedback when they have given correct answers. That situation may keep scores high and improve attitude.

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